Objectives: (1) Derive Gauss-Newton and Levenberg-Marquardt from Newton (2) Understand how to deal with equality and inequality constraints

Problem 1: Gauss-Newton

(a) Suppose you want to fit the function $f(t_i, x) = x_0e^{x_1t}$ to some data, say $(t_i, y_i)$ for $i = 1, \ldots, 4$. What function do you want to minimize?

(b) What is the gradient of this function?

(c) What is the difference between a Newton method for this problem and a Gauss-Newton method for this problem?

Problem 2: Constrained optimization

(a) What is the Lagrangian function for the following problem?

$$\min_{(x, y)} x^2 + y^2$$

subject to $x + y - 1 = 0$

(b) What system of equations would you consider to solve this constrained optimization problem?

(c) Are the solutions of this system guaranteed to be local minima of the constrained optimization problem?